



Great Lakes
and
Baltic Sea
Partnership



Interim report of research visit



of dr. Violeta Vinceviciene,
assoc. prof. and senior researcher at the Institute of
Environmental Engineering (APINI), Kaunas
University of Technology, Lithuania
staying with Ohio River Valley Water Sanitation
Commission (ORSANCO), USA
for the period 2000-02-02 --- 2000-07-31



Abbreviations

<i>APINI-</i>	<i>Institute of Environmental Engineering</i>
<i>BASINS -</i> <i>Sources</i>	<i>Better Assessment Science Integrating point and Non-point</i>
<i>BOD -</i>	<i>biochemical oxygen demand</i>
<i>CBLD -</i>	<i>Cincinnati Bell Long Distance Building</i>
<i>CEE -</i>	<i>Central and Eastern Europe</i>
<i>CU -</i>	<i>cataloguing units</i>
<i>DB -</i>	<i>databases</i>
<i>DSS -</i>	<i>decision support systems</i>
<i>EMS -</i>	<i>Environmental Management Systems</i>
<i>EPA -</i>	<i>Environmental Protection Agency</i>
<i>EU -</i>	<i>European Union</i>
<i>GIS -</i>	<i>Geographical Information System</i>
<i>GLBS Partnership Program –</i>	<i>Great Lakes Baltic Sea Partnership Program</i>
<i>GPS -</i>	<i>Geographical Positioning System</i>
<i>HUC -</i>	<i>hydrologic unit codes</i>
<i>KTU –</i>	<i>Kaunas University of Technology</i>
<i>MIS -</i>	<i>management information system</i>
<i>NAWQS -</i>	<i>National Water Quality Assessment Program</i>
<i>NPS -</i>	<i>non-point sources</i>
<i>NRMRL -</i>	<i>National Risk Management Research Laboratory</i>
<i>ORSANCO -</i>	<i>Ohio River Valley Water Sanitation Commission</i>
<i>PP/WM/CP -</i>	<i>Pollution prevention/ waste minimisation/ cleaner production</i>
<i>RF1, RF3 -</i>	<i>reach files</i>
<i>TDS -</i>	<i>total dissolved solids</i>
<i>TMDL –</i>	<i>total maximum daily load</i>
<i>TSS -</i>	<i>total suspended solids</i>
<i>USGS -</i>	<i>US Geological Survey</i>
<i>USDA</i>	<i>US Department of Agriculture</i>
<i>ZANDE -</i>	<i>Environmental Service, Inc.</i>
<i>WMS -</i>	<i>watershed modelling system</i>
<i>WQ -</i>	<i>water quality</i>

Table of contents

1.	The background, purpose and the main tasks of the visit.....	4
	<i>Fig.1.1. The basic research principles and activities of APINI in the three hierarchical levels of the river basin: (a) river basin level; (b) tributary/watershed or municipality level; (c) company level.</i>	5
2.	Work plan of the activities of the visit	7
3.	Activities performed during the period of stay February 2 nd – May 31 st , 2000.....	8
3.1.	Literature studies, development of the report.....	8
3.2.	Meetings, workshops, discussions	9
	<i>Table 3.1. Meetings, seminars, workshops and discussions.....</i>	10
3.3.	Training courses	17
	<i>Table 3.2. Data base (DB) development requirements for river basin management.....</i>	18
3.4.	Presentations.....	22
4.	Plan for June and July	23

1. The background, purpose and the main tasks of the visit

The background

The river basin management system studies in US could help to develop methodology for Lithuania in their process of approximation to EU, and reorganisation of water quality management system according basic EU Water Framework Directive. For the development of action plans the intellectual modelling tools – various types of mathematical models are needed. Some of the world-wide software, such as QUAL 2, WASP, MIKE11, STREAMPLAN already implemented and used at the Institute of Environmental Engineering (APINI) for the Nemunas, Nevezis, Vilnele, Kaunas Reservoir and Lielupe rivers since 1992. The basic investigations until present was based on the inventory, analysis of point sources, and simulations in the river channel has been performed for various point sources loading scenarios. Activities of the analysis and simulations on watershed modelling by evaluating non-point sources have started at APINI in 1999.

It was perceived that general strategy and methodology is needed in order to help our governmental institutions to set up the river basin management system in Lithuania. At the same time more comprehensive and additional models for this purpose are needed. These activities also are closely related to the development of environmental database for river basin management and modelling purposes. Development of specific GIS layers as the background for watershed characterisation, assessment and management is urgently needed as well.

The research visit to US is highly correlated with overall purpose of APINI research and strategy. APINI performs the research programme “Improvement of Environmental Performance by CP methods and its estimation by mathematical modelling” approved and funded by state research and studies foundation (1999-2005). The basic idea of the programme is – systems approach for the solving of environmental problems by using mathematical modelling in various hierarchical levels: river basin; municipal / administrative region; company level, etc. Methodology used for this purpose – systems approach and hierarchical approach. Research activities of APINI are concentrated on: (a) WQ modelling and management in the river basin in various hierarchical levels; (b) development and implementation of the concepts and techniques of Pollution Prevention / Waste Minimisation / Cleaner Production in Lithuania and other CEE & developing countries, (c) implementation of environmental management systems and standards (ISO 14001) for Lithuanian companies (see Fig.1.1).

The research visit to US is concentrated on gaining of experience and knowledge on development of river basin management concept and instruments –tools for that on river basin and watershed level. The experience gained during the visit could have several results-outputs: (a) the development of the concept and training material for river basin management for regional governmental institutions in Lithuania; (b) the development of the new curricula for MSc and PhD students in environmental engineering, (c) the expansion of the collaboration on various river basin modelling and management issues between US and Lithuania in research institutions and organisations.

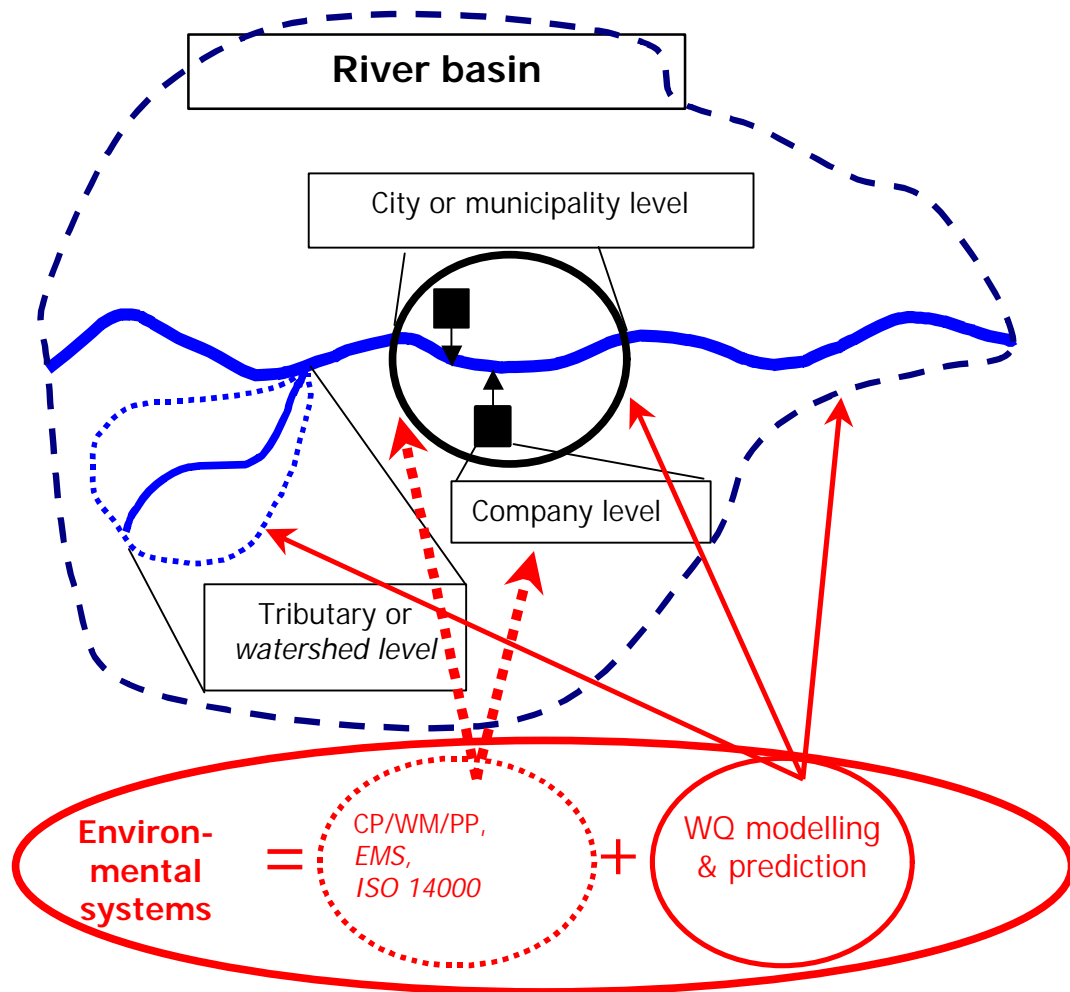


Fig.1.1. The basic research principles and activities of APINI in the three hierarchical levels of the river basin: (a) river basin level; (b) tributary/watershed or municipality level; (c) company level.

The purpose

The basic purpose of the research visit -

- to analyse river basin water quality management system in US and to analyse the possibilities of its adoption to Lithuanian conditions
- to search for modelling tools for the enhancement of existing surface water quality modelling issues at APINI in Lithuania and to select specific software for development of management scenarios for various purposes in Lithuanian river basins by generating catalogue of models for that purpose

The tasks

1. Development of the proposal of methodology for river basin management principles in Lithuania
2. Development of the proposal for methodology of DSS for Lithuanian conditions
3. Development of the proposal for methodology for the Action plan construction for Lithuanian rivers
4. Development of the catalogue of mathematical process-based models for action plans generation
5. Practical / engineering activities:
 - preliminary evaluation of existing data and their needs for watershed assessment in river basin management procedure
 - assessment of possibilities and/or practical adoption of NPS models (BASINS) for Lithuanian rivers

2. Work plan of the activities of the visit

Activities planned for all period of the visit (2000-02-02 --- 2000-07-31)

1. Analysis of river basin WQ management methodology in US.
 2. Development of the concept for WQ management in the river basin for Lithuanian conditions.
 3. DSS development studies, taking into account modelling as a key element for development of scenarios for river basin management. Analysis of possibilities for Lithuanian conditions
 4. Short review / analysis of data base system and MIS (management information system) in US
 5. Enhancement of the modelling system for surface water quality in Lithuania. The selection of “pool” of models for watershed modelling: non-point source modelling (NPS), modelling of spills, enhancement of surface water quality modelling in the river channel, watershed modelling, WQ modelling of reservoirs. Analysis of the possibilities for models adoption to Lithuanian rivers. (e.g. analysis of existing NPS models in US and selection the best available of those according present Lithuanian environmental data set / data base)
 6. Analysis of TMDLs strategy in US. Possibilities and analysis of their adoption for Lithuania.
 7. Analysis of the methodology of Action Plans’ development for US rivers. Analysis of the possibilities to develop the methodology for the action plan development for Lithuanian rivers (e.g. Lielupe river).
 8. Preparation of final report on the visit
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Note. Plan was discussed and revised according the comments of prof. Jurgis Staniskis – the Director of APINI.

3. Activities performed during the period of stay February 2nd – May 31st, 2000

3.1. Literature studies, development of the report

The basic literature studies have been performed on the analysis of the river basin management system in US and environmental data base system for watershed assessment. It was realised that there are several Federal institutions on the top level management, as Federal Regional EPA, USGS, US Army Corps of Engineers, USDA. There are also several States' level organisations as States EPAs. The other type, very unique organisations - interstate agencies, based on river basin level, such as ORSANCO (Ohio River Valley Water Sanitation Commission), perform the institutional strengthening and organisational work of practical river basin studies.

ORSANCO, created in 1948, as a basic Ohio river basin water quality management organisation, co-ordinates all the organisational activities on environmental studies, co-ordinates and partly performs various water quality related projects, e.g. development of bio-criteria, TMDLs for some parts of the Ohio river and tributaries, wet weather studies in Cincinnati, Louisville and Wheeling city districts, non-point source pollution studies and assessment of their impact to the Ohio river water quality, studies and analyses of oil spills to the Ohio River. ORSANCO also very active in organising various volunteer actions, such as volunteer monitoring programs in the river basin, river sweep annual actions, friends of Ohio River actions, etc. One of the basic responsibilities of ORSANCO is public awareness on quality of the river through various media (radio, TV, publication of various brochures). ORSANCO is responsible also for the publication of annual river basin water quality report on the state of the water quality in the Ohio. These activities are performed on the state and interstate level paying the attention to the river basin based management. These activities are based on unique / single program or project level.

At the same time, there are several existing National Programs, e.g. National Water Quality Assessment Program (responsible institution - USGS) on the national level.

The search and the selection of literature for studies was performed by using USEPA, U.S. Army Corps of Eng., USGS web-sites as well as visiting Public Library of Cincinnati, NRMRL USEPA library in Cincinnati and also ORSANCO local library. Materials on river basin management, action plan development for watershed, basic principles on country-wide water quality management of the rivers in US, examples of implementation of action plans, various types of software used for action plans development has been selected and studied.

Summing up literature studied, the first draft of the report (containing 109 pages approx.) on "Principles in river basin water quality management" has been prepared and work on this report continues. Possible applications of principles for river basin management in Lithuania (referring to the literature) are under development. The preliminary report consists of two parts. The first part is developed for the purpose of establishing country-wide watershed protection approach, and it is not technical guidance (or principles). It presents common themes or elements of watershed management with possible examples for Lithuanian conditions. The basic elements of country-wide approach, the benefits of country-wide watershed management, and beginning of

implementation of this approach for Lithuania are presented in the first part. This part intended for country water resource managers, and technical personnel as well as for the natural resource managers of local authorities with whom they co-operate. This part encourages the adoption of watershed-based water quality management by the other Baltic States. The second part of this report devoted to separate river basin or watershed management – a single project focus, or a development action plan for the management of the single river basin/watershed. The key elements of local-scale watershed projects in this part are described.

The division of the report into two parts is important in order to show that there are two basic points on implementing watershed management concept in the country. The first part – is to organise the system for watershed management, to set up the organisational and institutional issues. The second part – is devoted in order to show how the management should be organised and set up in a single watershed or river basin level. Compiling the separate action plans built for watersheds, sub-watersheds for various WQ problems, the total river basin management plan should set up.

The additional work on this report regarding description of TMDLs and selection of “pool” of models in order to use them for development various management options in Lithuania has been started. And these issues are on the plans for the last two months of the visit.

The additional contacts, meetings, various lectures and discussions (see 3.2 - 3.4 chapters) with professors of University of Illinois– Great Lakes Centre for Occupation and Environmental safety and Health at Chicago; University of Cincinnati from the Department of Civil and Environmental Engineering, and from the Department of Environmental Health; US EPA Region No.5 environmental experts in GIS, pollution prevention and watershed management; NRMRL US EPA experts from Water supply and Water resources division, Technology transfer division, and Sustainable technology division; leading researchers at US Army Corps of Engineers at Waterways Experiment Station in Vicksburg, MI as well as with leading environmental experts at ORSANCO have the impact in the process of understanding the system of river basin management and various other environmental protection activities in US. These contacts helps to collect and select the literature and appropriate models as well as to start closer co-operation and communication between researchers, scientists, experts on various environmental protection and natural systems analysis issues in US and Lithuania.

3.2. Meetings, workshops, discussions

During four months period of the visit 25 activities listed in Table 3.1 in terms of meetings, workshops, seminars, presentations, lectures and discussions took part. More detailed description of each activity is presented in chapters 3.3 - 3.4 and also in Table 3.1.

Table 3.1. Meetings, seminars, workshops and discussions

Activity name, date, place	Description	Names of persons taken part
1. Discussion, ORSANCO, Cincinnati, OH, 2000-02-09	<i>Presentation of APINI; first draft of revised work-plan; help needed for implementation of the plan</i>	Mr. Alan Vicory, Executive Director of ORSANCO, MSc. Jason Heath, ORSANCO; dr. James A. Goodrich, USEPA Cincinnati; dr. Walter M. Grayman, consulting engineer for ORSANCO
2. Discussion, ORSANCO, 2000-02-15	Discussion, demonstration of BASINS software application for Ohio river basin in ORSANCO	MSc. Debbie Olszowka – non-point source analysis specialist, ORSANCO
3. Discussion on research visit, ORSANCO, 2000-02-16	<i>Discussion of work-plan implementation, planning</i>	Mr. Vacys Saulys, US EPA Reg. No.5, Chicago
4. Workshop, Nashville, TE, 2000-02-24	Workshop on TMDLs, bio-criteria and nutrient criteria development. The performing projects and programs in Ohio river basin management was discussed. The basic principles on development of bio- and nutrient-criteria in US were proposed. Information on understanding TMDL and some information on application of modelling software as CE-QUAL-W2 from the workshop, as well as new contacts with researches on river basin management and modelling was established.	About 30 persons from various institutions in US related to Ohio river basin management.
5. BASINS Training course, Cincinnati, CBLD, 2000/02/29-03/03	<i>Training course for BASINS. Theoretical basis and practical work on using BASINS software system was performed. Understanding of basic principles of data and information management system in US as well as data needs for watershed characterisation and assessment was gained.</i>	About 25 participants and 2 lecturers and 4 assistants for the training on BASINS software system took part.
6. Presentation of EU Phare project results on Lielupe river basin,	<i>Results of the previous project on Lielupe river basin management performed in Lithuania and Latvia during the year 1999 has been presented.</i> The discussion on future planning on management system development for Lielupe river basin during	Tom Davenport (USEPA R5), Alan Vicory, Jason Heath (ORSANCO) took part in the discussion.

ORSANCO, 2000-03-07	GLBS Partnership program took place.	
7. Non-point source co-ordinators meeting for the Ohio river basin, Cincinnati, ORSANCO, 2000-03-08	Presentations and workgroup meeting about on-going activities in each state of the Ohio river basin based on NPS management. Presentation of ORSANCO strategy for non-point source pollution was presented. Evaluation of river water quality monitoring system and evaluation of river contamination by nutrients and bacteria was discussed. This gave the idea for the future organisation of similar studies in the river basins in Lithuania.	About 10 representatives from states EPA and US EPA Reg.5 and US EPA Reg.3 as well as 3 representatives from ORSANCO took part.
8. Presentation of new technologies of GPS, ORSANCO, Cincinnati, 2000-03-09	The basic principles by using GPS equipment and the new GPS technologies were presented by Bob Erdman from GPS Sales and technical support company Ellerbusch. This equipment could be used in the determination of surface water quality monitoring locations and point sources locations in Lithuania for development of adequate GIS layers.	The basic technical staff from ORSANCO took part (8 people totally).
9. Meeting at US EPA NRMRL, Water supply and water resources division, in Cincinnati, 2000-03-22	Visit to EPA NRMRL in Cincinnati with the purpose to get acquainted with the projects performed at water quality division on spill analysis, non-point sources pollution and various management scenarios under wet and dry weather and under global warming conditions	Water supply & resources division, Water Quality management branch, dr. James Goodrich
10. US EPA NRMRL seminar on NAWQA study of the Great and Little Miami River basins (Ohio river basin) in Cincinnati, 2000-03-30	US EPA NRMRL Watershed management team seminar on NAWQA study of the Great and Little Miami River basins (Ohio river basin). One practical approach from the National water quality assessment program study (performed by USGS) in the rivers mentioned above as an example has been presented by USGS dr. Gary Rowe	US EPA NRMRL Watershed management team and other staff from EPA departments took part.
11. Presentation and	Mr. Bob Ovies presented DB existing in ORSANCO for the	Mr. Bob Ovies (ORSANCO) – DB and GIS

basic structure of fish analyses - DB at ORSANCO, 2000-03-31	development of biocriteria on fish in Ohio river. This is based on Access software with some developed applications. It was noticed that the same software was used for Phare project in Lielupe river basin for the development of the data base for point sources and for surface water quality monitoring system.	specialist
12.Discussion and meeting on spill modelling in Ohio river, at ORSANCO, 2000-03-31	Presentation of the first draft spill model for Ohio river. WQ model development for spill analysis in the Ohio river was presented by dr. Walter Grayman. Model was constructed under the existing hydrodynamic model for Ohio. WQ part for the analysis of spill accidents has been presented (first approach). The developers presented the basic structure and some preliminary calibration results.	5 persons from ORSANCO took part: Sam Dinkins, Jim Gibson, Jason Heath, Jerry Schulte, Peter Tennant
13.Discussion on watershed modelling, NRMRL US EPA, Cincinnati, 2000-04-12	Presentation of software L-htia, demonstration some modelling applications and discussion on application to different watersheds. Discussion on GIS layers needed for the adoption of this software to Lithuanian conditions.	MSc. Emi Liu – watershed modelling specialist at NRMRL US EPA
14.Meeting and discussions US EPA Reg.5, Chicago, 2000-04-17	Several meetings and discussions on Sustainable development issues clean processes and products, on Future of Environmental Decision making – FIELDS program Update, on Pollution prevention programs, on review and discussions on Lielupe river PHARE project and Sesupe river activities has been made with several experts from US EPA Reg.No5 and APINI	Mr. John Grand, Milo Anderson, Phil Kaplan, Dolly Tong, Vacys Saulys, Tom Davenport, Janette Marsh from US EPA Reg.No.5 and prof. Jurgis Staniskis – APINI Director, Lithuania
15.Meeting and discussion at Illinois University, Chicago, 2000-04-18	Discussions on pollution prevention international activities, and possible co-operation between University of Illinois on Mariupole (Ukraine) study, and APINI activities has been discussed. The proposal for future co-operation has been generated.	Mr. Vacys Saulys – EPA Reg. No.5, dr. Daniel O. Hryhorczuk– Illinois Univ., prof. J. Staniskis – APINI KTU Lithuania.
16.Meeting and discussion on	Discussion on pollution prevention activities at Hazadours Waste Institute in Chicago and APINI in Kaunas, Lithuania	Mr. Vacys Saulys – EPA Reg. No.5, Mr. Malcom Boyle, Hazadours Wastes Research

pollution prevention problems at Hazadours Waste Institute in Chicago, 2000-04-18	took place. Possible information exchange and co-operation on pollution prevention methodology was discussed. The web-site page on pollution prevention methodology was demonstrated.	and Information Centre, prof. J. Staniskis – APINI KTU Lithuania.
17. Presentation of APINI activities at NRMRL US EPA, in Cincinnati, 2000-04-20	<i>Two hours presentation “Toward Implementation of Sustainable Development and River Basin Management in Lithuania” at NRMRL with video link to Ada and Edison Conference rooms in the other cities has been made by dr. V. Vinceviciene and dr.hab. Jurgis Staniskis</i>	The representatives from NRMRL US EPA from Water supply and Water resources division, Technology transfer division, Sustainable technology division and other departments took part.
18. Meeting and discussion on environmental problems at University of Cincinnati Dept. of Environmental Health and safety, in Cincinnati, 2000-04-21	Discussion on research and teaching activities at APINI at Kaunas University of Technology and at the Dept. of Environmental Health and Safety at university of Cincinnati took place. The environmental laboratories on air pollution analysis were visited.	Staff of Dept. of Environmental Health and Safety including prof. Klaus Willeke, dr. Saulius Trakumas, dr. Sergey Grinshpun, dr. Tiina Reponen, PhD cand. Gediminas Mainelis took part.
19. Meeting and discussion on laboratory issues at Ohio EPA Central lab., and ZANDE Corp. Ltd. lab. in Columbus, 2000-04-24	Meeting and discussion on laboratory analysis issues at Ohio EPA Central lab., and ZANDE laboratory took place. The discussion with leading modeller at ZANDE private company, which is working under contract for Ohio EPA was organised. The models used at ZANDE and APINI for river water quality modelling and watershed modelling was discussed. The difficulties for BASINS implementation (due to very big amount of data and information needed) for Ohio EPA was discussed.	Dr. Gerry Ioannides, dr. Ayse French from ZANDE Associates Inc. Consulting engineers laboratory staff (4 persons) and Ohio EPA lab. staff (3 persons)..
20. Meeting and discussion at	Meeting and discussion with leading researchers and professors on various environmental issues research and studies (e.g.,	Prof. Paul Bishop, prof. P. Scarpino, dr. Steven Buchberger, dr. Helmut Elsenbeer,

University of Cincinnati, Dept. of Environmental Engineering, Cincinnati, 2000-04-27	pollution prevention, drinking water studies, diffusive pollution studies and evaluation) at Dept. of Environmental Engineering University of Cincinnati was organised.	prof. J. Staniskis
21. Visit at US Army Corps of Engineers, WES, Vicksburg, MI, 2000-05-01 –02	<p><i>The one-hour presentation of APINI activities on various environmental protection issues was made.</i> The activities as visiting researcher on GLBS partnership program has been presented and discussed.</p> <p>The presentation of organisational structure of US Army Corps of Engineers and WES research activities was presented. The environmental laboratory was visited. Meetings on various environmental engineering issues and research related to river, watershed, reservoirs modelling and management took part. Meetings and discussions lasted all two days from 8:00AM to 5:00 PM with 12 leading researchers at Waterways Experiment Station. The presentation and discussions on models – WMS, GMS, CE-QUAL-W2, CE-QUAL-ICM, RIV1-QUAL was made. Watershed analysis and assessment by using GIS was presented, intensive water quality monitoring system for selected watershed by using GIS information was discussed and demonstrated. Fish population and migration modelling for risk assessment analysis has been demonstrated. Possible collaboration on implementation of water quality modelling issues was discussed.</p>	More than 15 WES researchers took part during APINI activities' presentation and during two working days discussions on river basin water quality modelling and management issues. Those are – dr. James Martin, dr. Robert Kennedy, dr. Rose Kress, dr. Mark Dorch, dr. Barry Bunch, dr. Zakikhani, dr. Patrick Deliman, dr. Carlos Rviz, etc.
22. Discussion on wet weather project at ORSANCO, Cincinnati, 2000-05-10	ORSANCO wet weather project purpose, research objectives, monitoring system development and organisation, and studies planned to perform, was discussed. It was emphasised that for wet weather impact analysis to the river water quality monitoring and information on the loads from tributaries, CSO and in the main river channel should be known. Three cities on the Ohio river – Cincinnati, Louisville and Wheeling were	John McManus – manager on wet weather project in Ohio river at ORSANCO

	<p>selected for studies. The selected parameters for the studies were TSS, TDS, Chl_a, nutrients, BOD, temperature and E.Coli form. The stormwater monitoring system was described and discussed. This could be as a good example for lacking monitoring and studies of stormwater in Lithuania.</p>	
<p>23. One week seminar at US EPA Reg. No.5, Chicago, 2000-05-15 - 19</p>	<p>A big number of various topics on river basin management system and specific project studies were presented to Baltic group by USEPA staff. USEPA Water division overview, organisational structure, responsibilities and activities were presented by Timothy Henry. Wetlands protection and management, CSO control approaches and some modelling results on hazardous waste sites by application GIS was presented by Tim Drexler and Jeffrey Gagler. Watershed management overview, Clean Water Action Plan, Water Quality Standards, Monitoring system, Drinking Water Standards and Wellhead Protection methodology as well as practical examples of watershed management was presented by US EPA staff. Academia activities in watershed management, investigations and research going at University of Georgia was presented by leading professors of the Univ. of Georgia.</p>	<p>GLBS Partnership pilot projects team from Baltic countries (14 Ministerial representatives from Estonia, Latvia, Lithuania, Russia, Kaliningrad region) as well as US EPA Reg. No.5 some staff and leading professors from University of Georgia participated (5 professors and PhD)..</p>
<p>24. One week seminar at ORSANCO, Cincinnati – Lexington, 2000-05-22 - 26</p>	<p>During the one week period three days seminars and tours were organised by ORSANCO staff, and two day seminar of ORSANCO Technical Committee and Commissioners Meeting took place.</p> <p>During the seminars organisational structure of ORSANCO as interstate institution – Commission - for river basin management was presented. The Commission consists of Technical Committee, Advisory Committee, Special Committees and permanent ORSANCO staff. ORSANCO activities on public awareness, and execution of various projects in Ohio river basin management was presented by ORSANCO staff and various Committees members (e.g., Mill Creek restoration project, Evaluation of early warning</p>	<p>GLBS Partnership pilot projects team from Baltic countries (14 Ministerial representatives from Estonia, Latvia, Lithuania, Russia, Kaliningrad region) as well as ORSANCO staff (23 person) involved in GLBS pilot project and also ORSANCO system Commissioners (totally 40 people approx.).</p>

	monitoring system by using modelling). Tours to Cincinnati Drinking Water treatment facility, to P&G experimental stream facility, and to Cincinnati Wastewater treatment facility was organised.	
25. One day wet weather sampling in the Ohio river with the team of wet Weather project studies at ORSANCO, 2000-05-31	Practical water quality sampling along the Ohio river in the distance of 70 miles (from river mile 460 until river mile 530) was performed. Every 5 miles the surface water samples for bacteria, nitrates, ammonia, TKN, BOD, orthophosphates, chl _a were collected and parameters by using <i>Hydrolab</i> such as conductivity, temperature, DO, pH at 3 depth levels (bottom, middle and surface) in the middle of the river cross-section were measured. The transparency by using Secci-disk was measured.	John McManus, Kim Mayers, Jerry Schulte
26. Ohio river basin TMDL work group meeting, ORSANCO, 2000-06-02	States' experts' reports on TMDL activities of the Ohio river basin were presented. The list of impaired waters by some contaminants according to CWA (305b) and (303d) in each State was presented and discussed. It was summarised that the basic pollutants in the Ohio river are organics and in some places – metals. ORSANCO project on dioxin TMDL development for 50 mi Ohio river reach downstream confluence Kanawha river with Ohio was presented (monitoring, modelling results) and the second draft of the report was discussed.	Person responsible for TMDL in states of Kentucky, Pennsylvania, West Virginia, Indiana, Illinois, Ohio EPA, representatives from USEPA Reg. No.3, USEPA Reg.5, and EPA Headquarters as well as three leading experts from ORSANCO (Peter Tennant, Jason Heath and Sam Dinkins) participated.

3.3. Training courses

During the first part of the visit one week training courses on BASINS modelling software organised by NRMRL US EPA (2000-02-29 - 2000-03-03) was attended and the certificate of qualification while passing full course training was obtained. The lectures and the practical work with BASINS software during the courses helped to understand the basic principles on river basin management in US, the system of environmental databases, and GIS layers needed for watershed modelling and management as well as for watershed characterisation and problem definition. The comparison of databases needed for BASIN modelling in US and Lithuania was prepared, and lacking databases and GIS layers for Lithuanian rivers (in order to set up watershed modelling system) was determined. It was realised that the main obstacle in order to set BASINS modelling system for Lithuanian rivers are the lacking watershed delineation system (as HUCs system in US) and also river reach system codification and GIS layer (as RF1 or RF3 layers in US). Ore detailed review and comparison of databases and GIS layers available in Lithuania is presented in Table 3.2. The first column of the Table 3.2 represents all data needed to make watershed characterisation and assessment according BASINS modelling software requirements (as it is performed as common procedure in US EPA).

It should be noticed that there is an urgent need to create river reaches data files, to review the existing and upgrade codification system of the rivers in Lithuania and to perform watershed, and sub-watershed delineation, and also to create GIS layers for that. The appropriate literature with the example of 8-digit HUCs system in US for watershed codification was obtained contacting USGS experts and local ORSANCO experts.

The next step in order to start to make computerised watershed characterisation (see GIS layers listed in Table 3.2) review of existing GIS layers should be performed.

After these steps the BASINS modelling software could be applied for watershed characterisation, problem definition and also for watershed water quality modelling in order to analyse the impact of point and non-point sources of pollution to the river and to generate / simulate some scenarios for river basin management.

This is one of the possible technology transfer scenarios from US to Lithuanian conditions.

Table 3.2. Data base (DB) development requirements for river basin management

DATA TYPE for watershed assessment, modelling and decision making	Current state		What was done in Phare project	What should be improved
	Source, institution	format		
1	2	3	4	5
Spatial data				
1. Water-shed boundaries , hydro-logic unit boundaries (like CU, or HUC in US)	Hydrographical Network Service (HNS) service at MoE of Lithuania, and Lab. of Hydrology at Institute of Energy (LEI)	The delineation of river basins and their watersheds / sub-watersheds exists on hard copies in the maps only	The delineation of Lielupe and Venta basins (shape file for total basin only) is developed under scale of M1: 200000 basin	<p>1. United codification system for transboundary watersheds should be set up</p> <p>2. Digital GIS coverage should be developed for two cases: (1) the main river basin and also with the subdivision of it into 1st order tributaries; (2) more detailed – the main river and including 1st, 2nd, 3rd and 4th order tributaries – for the purpose of more detailed studies.</p> <p>3. Delineation of river basin and watersheds of the 1st order in (1) case and more detailed delineation of sub-watersheds for (2) case compatible with should be developed (like the system in US with CU and HUC exists)</p>
2. Stream codification and network (like RF1, RF3 in US)	HNS service at MoE, Lithuanian Cadastre of rivers (old FY62) Cadastre of ponds and reservoirs (FY99). Some codification system (?) exist at Joint Research Centre in old-fashioned DB "VANDUO" But the description is not available.	May-be some soviet (old) codification on rivers exist in hard copies only Some river system codification in old-fashioned DB "VANDUO" for river WQ monitoring exist, but it is not clearly defined system and doubtfully it could be used as a reference system for the development unified codification system for transboundary rivers (<i>not clear at the moment</i>)??	<p>1. For the Lielupe & Venta river basins the network of main rivers for LT and LV from LKS200 has been delineated for the purpose to develop the additional layers to represent results of ecological analysis of Phare project.</p> <p>2. Schematic diagram of the main river and tributaries (until 4th level) referring to cadastral data has been developed in order to represent WQ and gauging stations as well as all point sources which inventory and DB has been developed during the project</p>	Very clear and strictly defined united codification system for transboundary rivers network , e.g. for Lielupe including Lithuanian part and Latvian part and their digital coverages (like in US reach file-1 RF1 and RF3) should be developed for two cases: (1) the main river and the 1st order tributaries; (2) more detailed – the main river and including 1 st , 2 nd , 3 rd and 4 th order tributaries – for the purpose of more detailed studies in "hot spots"

Table 3.2. (continued) Data base (DB) development requirements for river basin management

DATA TYPE for watershed assessment, modelling and decision making	Current state		What was done in Phare project	What should be improved
	Source, institution	format		
1	2	3	4	5
3. Land use & land cover	1. Statistical Dept. at the Government of Lithuania; 2. HNIT-BALTIC; EU PHARE Program	1. Statistical summary values of land use for each administrative region in Lithuanian statistics 2. CORINE GDB 1: 100 000	Statistical information from Lithuanian Statistics was used for description and characterisation of the river basin, and GIS coverages (shape files) of agricultural land and forest land use from LKS200	LKS200 some GIS coverages as forest land, agricultural land, lakes, wetlands could be used for general characterisation and analysis of the total river basin, and additionally for more precise characterisation of more detailed land use types - CORINE GDB 1:100 000 could be used
4. Soil type	Land Management Institute at the Government of Lithuania	Old hard copies paper maps are available, and M 1: 300 000 digital map and M 1:1 000 000 exists (at the end of 1999)	Hard copies and literature (Soviet atlas of 1980) were used for basin description and watershed characterisation as well as other available hard-copy literature and maps included to it	Digital map M 1:300 000 should be used, and DB with classification and description of soil types should be generated9usedif it exist??)
5. Urbanised areas (cities) and settlements	<i>Lithuanian Statistical Department at the Government of Lithuania</i> HNIT-Baltic – Lithuania, GIS Centre (Lit.)	Statistical summary on population in Lithuanian Statistics GDB LKS200 and GDBLKS50 as well as Corine GDB100 coverages	Statistical summary from Lithuanian Statistics was used for basin description and characterisation, and LKS200 cities and settlements GIS layers was used for visualisation	LKS 200 layers should be used, and additionally supplementary CORINE DGB100 additional detailed layers on land use could be used as well in some more detailed description of the river basin. But these layers should contain more information on number of inhabitants in cities, more detailed description on impervious and pervious areas in the territory of the cities, the information on the areas of settlements, number of inhabitants could be added to existing GIS layers on cities and settlements. The additional information could be collected from Lithuanian statistical department and their branches

Table 3.2. (continued) Data base (DB) development requirements for river basin management

DATA TYPE for watershed assessment, modelling and decision making	Current state		What was done in Phare project	What should be improved
	Source, institution	format		
1	2	3	4	5
Environmental monitoring data				
6. WQ monitoring stations	MoE, JRC and Regional EPD	Old-fashioned FoxPro based DB "Vanduo" at JRC at MoE: Hydrochemical and physical data, sedimentary data, Radiology, heavy metals data (total - over 70 parameters)	Some info from MoE JRC "Vanduo" DB was extracted, and basically info from Regional .EPD have been collected New DB based on EXCEL – ACCESS was constructed with some application	To fill DB with the new data continuously To determine the exact locations of monitoring posts (by using GPS), to include this information to developed DB and to connect WQ DB with GIS spatial data developing new GIS layer for WQ monitoring stations
	JRC at MoE, lab. of hydrobiology and bacteriology	Hydrobiology, bacteriology data – is not included in DB "Vanduo"	Data has been collected directly at Hydrobiological lab. (hard copies were available only!) and were put into EXCEL format for analysis and plots for the analysis has been generated. His data (due to lack of time) were not included into new DB (lack of time!)	Should be included into new developed DB and applications for the analysis should be developed More applications by using DB data could be generated
7. Weather stations	Hydromet Service (HMS) at MoE	The map with locations of weather stations exist (hard copy?) but not digital coverage	Only weather data for characterisation of river basin was used	GIS coverage with weather stations locations and the division of the total territory according the station locations as reference to use the data from the locations should be developed. DB of an appropriate format, compatible to GIS should be developed

Table 3.2. (continued) Data base (DB) development requirements for river basin management

DATA TYPE for watershed assessment, modelling and decision making	Current state		What was done in Phare project	What should be improved
	Source, institution	format		
1	2	3	4	5
8. Drinking water supply sites	LGS survey and Ministry of Health protection	Mostly ground-water is used for drinking purposes LGS is responsible for the monitoring of dug wells and drilled wells quantity and quality Drinking water quality monitoring, which is supplied to drinking water network is controlled by Ministry of Health protection.	Groundwater quality state estimation in the Lielupe and Venta river basins has been performed together with the LGS	Coverage should be developed and DB should be generated or adopted from LGS survey

Explanation to abbreviations used in Table 3.2.

MoE – Ministry of Environment

LGS – Lithuanian geological survey at MoE

JRC – Joint Research Centre at MoE

HNS – Hydrographical network service at MoE

HMS - Hydrometservice

DB – database

EPD – Environmental Protection Department

CU – Cataloging unit (used in US)

HUC – hydrological cataloging unit (used in US)

RF1, RF3 – river reaches files system in US

3.4. Presentations

The official presentations on APINI activities in various environmental issues highlighting water quality modelling and management research activities as well as pollution prevention activities) were presented in various places and leading environmental organisations, listed below (see also Table 1):

- at ORSANCO as interstate organisation dealing with river basin management
- at US EPA National Risk Management Research laboratory (NRMRL) – as leading US EPA organisation on various research programs
- at US Army Corp of Engineers Waterways Experiment Station (Vicksburg, MI) as leading US Army Corps of Engineers research institution in developing various mathematical models for river basin management and analysis of environmental behaviour of various water courses in US

Few meetings on FY 1999 Phare project on Lielupe river basin results has been presented at ORSACO and US EPA Reg. No5 to Great Lakes Baltic Sea (GLBS) Partnership program specialists in order to inform and to connect the previous studies on the Lielupe river with the on-going GLBS Partnership pilot project studies (see Table 1).

During various visits to the other leading Federal, State and Academia organisations dissemination of APINI research activities on water quality modelling and management was presented, and the contacts with USGS hydrologic specialists, US Army Corps of Eng. specialists, Academia leading specialists - as University of Cincinnati (OH), University of Illinois (IL), and University of Georgia (GE) - was established.

Also personal contacts on watershed modelling and pollution prevention issues with experts from various institutions and organisations (state level as well as private companies) in US was established. For *pollution prevention* it includes NRMRL at US EPA in Cincinnati, US EPA Region No.5 in Chicago, Illinois Waste Management Research Centre in Chicago, University of Cincinnati. For *river basin modelling and GIS system* it includes US Army Corps of Eng. WES in Vicksburg, US EPA Reg.No.5 in Chicago, NRMRL at US EPA in Cincinnati, ORSANCO in Cincinnati, private consulting companies – ZANDE in Columbus (OH), Global Quality Corp. in Cincinnati (OH), FTN associates Ltd in Little Rock (AR).

4. Plan for June and July, 2000

1. The literature on various mathematical models has been selected. Studies of the literature and selection of pool of models will take place during June, 2000
2. The literature on developing TMDL was collected. The studies on literature will take place during June and July, 2000
3. The preparation of the second draft on “Principles in River basin water Quality management” (methodology and applications for Lithuania) will take place during June and July, 2000

Some comments on the first draft “Principles in River basin water Quality management (methodology and applications for Lithuania)”. The “Principles...” containing 109 pages (approx.) was discussed with prof. Jurgis Staniskis – the Director of the APINI. It was decided to revise slightly the structure of the report highlighting the methodological part and the applicational part to Lithuanian conditions. It was noticed that this report could be the basis for the authors’ monograph on the principles of river basin management for Lithuanian conditions and could be translated into Lithuanian language. This book could be prepared for printing during the one-year period, starting from September, 2000, if additional financing from GLBS Partnership program will be available. The book would be useful for the training of regional EPD on implementation of river basin management principles and action plan development as well as new curricula for the environmental courses for MSc and PhD students in environmental engineering at Kaunas University of Technology and other Universities in Lithuania.